

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Sei-Hyung Ryu

Serial No.: To Be Assigned

Filed: Concurrently Herewith

For: VERTICAL JFET LIMITED SILICON CARBIDE POWER METAL-OXIDE
SEMICONDUCTOR FIELD EFFECT TRANSISTORS AND METHODS OF
FABRICATING VERTICAL JFET LIMITED SILICON CARBIDE METAL-OXIDE
SEMICONDUCTOR FIELD EFFECT TRANSISTORS

Date: October 30, 2003

Mail Stop Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)

Sir:

Attached is a list of documents on Form PTO-1449, together with a copy of any listed foreign patent document and/or non-patent literature. A copy of any listed U.S. patent and/or U.S. patent application publication is not provided herewith in accordance with the waiver by the U.S. Patent and Trademark Office of requirements under 37 C.F.R. § 1.98(a)(2)(i) for all U.S. national patent applications filed after June 30, 2003 and for all international applications that have entered the national stage under 35 USC § 371 after June 30, 2003.

It is requested that these documents be considered by the Examiner and officially made of record in accordance with the provisions of 37 C.F.R. § 1.56 and Section 609 of the MPEP.

No fee is believed due. However, the Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-0220.

Respectfully submitted,



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CERTIFICATE OF MAILING UNDER 37 CFR § 1.10

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Date of Deposit: October 30, 2003

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Candi L. Riggs

FORM PTO-1449 U.S. Department of Commerce Patent and Trademark Office LIST OF DOCUMENTS CITED BY APPLICANT (Use several sheets if necessary)				Attorney Docket Number: 5308-279		Serial No.: To Be Assigned	
				Applicants: Sei-Hyung Ryu			
				Filing Date: Concurrently Herewith		Group Unknown	
U. S. PATENT DOCUMENTS							
Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
	1	6,593,620	7/15/03	Hshieh et al.	257	335	
	2	6,455,892	9/02	Okuno	257	77	
	3	6,344,663 B1	2/5/02	Slater, Jr. et al.	257	77	
	4	6,297,172	10/2/01	Kashiwagi	438	773	
	5	6,246,076 B1	6/12/01	Lipkin et al.	257	77	
	6	6,239,463	5/29/01	Williams et al.	257	328	
	7	6,238,967 B1	5/29/01	Shiho et al.	438	244	
	8	6,221,700	4/24/01	Okuno et al.	438	151	
	9	6,211,035	4/01	Moise et al.	438	396	
	10	6,204,203	3/01	Narwanker et al.	438	785	
	11	6,190,973 B1	2/20/01	Berg et al.	438	275	
	12	6,165,822	12/26/00	Okuno et al.	438	142	
	13	6,136,728	10/24/00	Wang			
	14	6,117,735	9/12/00	Ueno	438	268	
	15	6,107,142	8/22/00	Suvorov et al.	438	285	
	16	6,100,169	8/8/00	Suvorov et al.	438	519	
	17	6,096,607	8/1/00	Ueno	438	522	
	18	6,063,698	5/16/00	Tseng et al.			
	19	6,054,352	4/25/00	Ueno	438	268	
	20	6,048,766	4/11/00	Gardner et al.			
	21	6,028,012	2/22/00	Wang			
	22	6,025,608	2/15/00	Harris et al.	257	77	
	23	5,972,801	10/26/99	Lipkin et al.	438	770	
	24	5,972,801	10/26/99	Lipkin et al.	438	770	
	25	5,960,289	9/28/99	Tsui et al.	438	257	
	26	5,939,763	8/17/99	Hao et al.	257	411	
	27	5,885,870A	3/99	Maiti et al.	438	261	

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	28	5,837,572	11/17/98	Gardner et al.	438	199		
	29	5,763,905	6/9/98	Harris	257	77		
	30	5,726,463	3/10/98	Brown et al.	257	77		
	31	5,510,630	4/23/96	Agarwal	257	77		
	32	5,506,421	4-9-96	Palmour	257	77		
	33	5,184,199	2/2/93	Fujii et al.	29	10		
	34	5,170,455	12/8/92	Goossen et al.	385	89		
	35	5,170,231	12/92	Fujii et al.	257	77		
	36	4,875,083	10/17/89	Palmour	357	23.6		
	37	4,466,172	8/21/84	Batra	29	571		
	38	3,924,024	12/2/75	Naber et al.	427	95		
	39	2002/0072247	6/13/02	Lipkin et al.	438	767		
	40	2001/0055852	12/01	Moise et al.	438	396		
FOREIGN PATENT DOCUMENTS								
		Document Number	Date	Country	Class	Subclass	Translation Yes No	
	41	0637069 A1/ B1	2/1/95	EPO				
	42	DE 10036208	2/14/02	Germany			Abstract	
	43	DE 198 09 554	9/10/98	Germany			Abstract	
	44	DE 19900171	12/26/00	Germany			Abstract	
	45	JP 03157974	7/5/91	Japan			Abstract	
	46	JP 08264766	10/11/96	Japan			Abstract	
	47	JP 09205202	8/5/97	Japan			Abstract	
	48	JP 11191559	7/13/99	Japan			Abstract	
	49	JP 11238742	8/31/99	Japan			Abstract	
	50	JP 11261061	9/24/99	Japan			Abstract	
	51	JP 11266017	9/28/99	Japan			Abstract	
	52	JP 11274487	10/8/99	Japan			Abstract	
	53	JP 2000049167	2/18/00	Japan			Abstract	
	54	JP 2000082812	3/21/00	Japan			Abstract	

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	55	JP 2000106371	4/11/01	Japan			Abstract
	56	JP0200025246	9/14/00	Japan			Abstract
	57	WO 97/17730	5/15/97	PCT			
	58	WO 97/39485	10/23/97	PCT			
59 OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)							
	59	A.K. Agarwal, J.B. Casady, L.B. Rowland, W.F. Valek, and C.D. Brandt, "1400 V 4H-SiC Power MOSFET's," <i>Materials Science Forum</i> Vols. 264-268, pp.989-992, 1998.					
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	61	A.K. Agarwal, N.S. Saks, S.S. Mani, V.S. Hegde and P.A. Sanger, "Investigation of Lateral RESURF, 6H-SiC MOSFETs," <i>Materials Science Forum</i> , Vols. 338-342, pp. 1307-1310, 2000.					
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	63	A.V. Suvorov, L.A. Lipkin, G.M. Johnson, R. Singh and J.W. Palmour, "4H-SiC Self-Aligned Implant-Diffused Structure for Power DMOSFETs," <i>Materials Science Forum</i> Vols. 338-342, pp. 1275-1278, 2000.					
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	65	Chakraborty et al. "Interface Properties of N ₂ O-annealed SiO ₂ /SiC system," <i>Proceedings IEEE Hong Kong Electron Devices Meeting</i> . June 24, 2000, pp. 108-11.					
	66	Chang et al. "Observation of a Non-stoichiometric Layer at the Silicon Dioxide--Silicon Carbide Interface: Effect of Oxidation Temperature and Post-Oxidation Processing Conditions," <i>Mat. Res. Soc. Symp. Proc.</i> Vol. 640, 2001.					
	67	Cho et al. "Improvement of charge trapping by hydrogen post-oxidation annealing in gate oxide of 4H-SiC methel-oxide-semiconductor capacitors," <i>Applied Physics Letters</i> . Vol. 77, No. 8, pp. 1215-7.					
	68	Chung et al., "The Effect of Si:C Source Ratio on SiO ₂ /SiC Interface State Density for Nitrogen Doped 4H and 6H-SiC," <i>Materials Science Forum</i> . (2000) Vols. 338-342, pp. 1097-1100.					
	69	Copy of International Search Report for PCT/US01/30715.					
	70	Copy of International Search Report for PCT/US02/11691 dated 12/4/02.					
	71	Copy of International Search Report for PCT/US01/42414, dated 4/23/02					
	72	D. Alok, E. Arnold, and R. Egloff, "Process Dependence of Inversion Layer Mobility in 4H-SiC Devices," <i>Materials Science Forum</i> , Vols. 338-342, pp. 1077-1080, 2000.					
	73	Das, Mrinal K. Graduate thesis entitled, <i>Fundamental Studies of the Silicon Carbide MOS Structure</i> . Purdue University, 1999.					

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		Filing Date: Concurrently Herewith	Group Unknown
	74	Fukuda et al. "Improvement of SiO ₂ /4H-SiC Interface Using High-Temperature Hydrogen Annealing at Low Pressure and Vacuum Annealing," <i>Jpn J. Appl. Phys.</i> Vol. 38, April 1999, pp. 2306-9	
	75	Fukuda et al. "Improvement of SiO ₂ /4H-SiC Interface by Using High Temperature Hydrogen Annealing at 1000° C," <i>Extended Abstracts of the International Conference on Solid State Devices and Materials</i> . Japan Society of Applied Physics, Tokyo, Japan, Sept. 1998.	
	76	G.Y. Chung, C.C. Tin, J.R. Williams, K. McDonald, M. Di Ventra, S.T. Pantelides, L.C. Feldman, and R.A. Weller, "Effect of nitric oxide annealing on the interface trap densities near the band edges in the 4H polytype of silicon carbide," <i>Applied Physics Letters</i> , Vol. 76, No. 13, pp.1713-1715, March 2000.	
	77	G.Y. Chung, C.C. Tin, J.R. Williams, K. McDonald, R.K. Chanana, R.A. Weller, S.T. Pantelides, L.C. Feldman, O.W. Holland, M.K. Das, and J.W. Palmour, "Improved Inversion Channel Mobility for 4H-SiC MOSETs Following High Temperature Anneals in Nitric Oxide," <i>IEEE Electron Device Letters</i> , Vol. 22, No. 4, April 2001.	
	78	H.F. Li, S. Dimitrijević, H.B. Harrison, D. Sweatman, P.T. Tanner. "Improving SiO ₂ Grown on P-Type 4H-SiC by NO Annealing," <i>Materials Science Forum</i> . Vols. 264-268 (1998) pp. 869-872.	
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	80	J.B. Casady, A.K. Agarwal, L.B. Rowland, W.F. Valek, and C.D. Brandt, "900 V DMOS and 1100 V UMOS 4H-SiC Power FETs," <i>IEEE Device Research Conference</i> , Ft. Collins, CO June 23-25, 1997.	
	81	J.N. Shenoy, J.A. Cooper and M.R. Meelock, "High-Voltage Double-Implanted Power MOSFETs in 6H-SiC," <i>IEEE Electron Device Letters</i> , Vol. 18, No. 3, pp.93-95, March 1997	
	82	Jamet, et al. "Physical properties of N ₂ O and NO-nitrided gate oxides grown on 4H SiC," <i>Applied Physics Letters</i> . Vol. 79, No.3, July 16, 2001, pp. 323-5.	
	80	K. Ueno and Tadaaki Oikawa, "Counter-Doped MOSFET's of 4H-SiC," <i>IEEE Electron Device Letters</i> , Vol. 20, No. 12, pp. 624-626, December 1999.	
	84	K. Ueno, R. Asai, and T. Tsuji. "4H-SiC MOSFET's Utilizing the H ₂ Surface Cleaning Technique." <i>IEEE Electron Device Letters</i> , Vol. 19, No. 7, July 1998, pp. 244-246.	
	85	L.A. Lipkin and J.W. Palmour, "Low interface state density oxides on p-type SiC," <i>Materials Science Forum</i> Vols. 264-268, pp. 853-856, 1998.	
	86	Lai et al., "Interface Properties of N ₂ O-Annealed NH ₃ -Treated 6H-SiC MOS Capacitor," <i>Proc. 1999 IEEE Hong Kong Electron Devices Meeting</i> , June 26, 1999, pp. 46-9	
	87	Leonhard et al. "Long term stability of gate-oxides on n- and p-type silicon carbide studied by charge injection techniques," <i>Materials Science Engineering</i> , Vol. 46, No. 1-3, April 1997, pp. 263-6.	
	88	Lipkin et al. "Insulator Investigation on SiC for Improved Reliability," <i>IEEE Transactions on Electron Devices</i> . Vol. 46, No. 3, March 1999, pp. 525-32.	
	89	Lipkin et al. "Challenges and State-of-the-Art Oxides in SiC," <i>Mat. Res. Soc. Symp. Proc.</i> Vol. 640, 2001, pp. 27-29.	

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		Applicants: Sei-Hyung Ryu	
		Filing Date: Concurrently Herewith	Group Unknown
90	M. K. Das, L.A. Lipkin, J.W. Palmour, G.Y. Chung, J.R. Williams, K. McDonald, and L.C. Feldman, "High Mobility 4H-SiC Inversion Mode MOSFETs Using Thermally Grown, NO Annealed SiO ₂ ," <i>IEEE Device Research Conference</i> , Denver, CO June 19-21, 2000.		
91	M.A. Capano, S. Ryu, J.A. Cooper, Jr., M.R. Melloch, K. Rottner, S. Karlsson, N. Nordell, A. Powell, and D.E. Walker, Jr., "Surface Roughening in Ion Implanted 4H-Silicon Carbide," <i>Journal of Electronic Materials</i> , Vol. 28, No. 3, pp. 214-218, March 1999.		
92	M.K. Das, J.A. Cooper, Jr., M.R. Melloch, and M.A. Capano, "Inversion Channel Mobility in 4H- and 6H-SiC MOSFETs," <i>IEEE Semiconductor Interface Specialists Conference</i> , San Diego, CA, December 3-5, 1998.		
91	P.J. Tobin, Y. Okada, S. A. Ajuria, V. Lakhota, W.A. Feil, and R. I. Hedge, "Furnace formation of silicon oxynitride thin dielectrics in nitrous oxide (N ₂ O): The role of nitric oxide (NO)." <i>Journal of Applied Physics</i> . Vol. 75, No. 3, February 1, 1994, pp. 1811-1817.		
94	P.M. Shenoy and B.J. Baliga, "The Planar 6H-SiC ACCUFET: A New High-Voltage Power MOSFET Structure," <i>IEEE Electron Device Letters</i> , Vol. 18, No. 12, pp. 589-591, December 1997.		
95	P.T. Lai, Supratic Chakraborty, C.L. Chan, and Y.C. Cheng, "Effects of nitridation and annealing on interface properties of thermally oxidized SiO ₂ /SiC metal-oxide-semiconductor system," <i>Applied Physics Letters</i> , Vol. 76, No. 25, pp. 3744-3746, June 2000.		
96	Pantelides et al., "Atomic-Scale Engineering of the SiC-SiO ₂ Interface," <i>Materials Science Forum</i> . (2000) Vols. 338-342, pp. 1133-1136.		
97	R. Schörner, P. Friedrichs, D. Peters, H. Mitlehner, B. Weis, and D. Stephani, "Rugged Power MOSFETs in 6H-SiC with Blocking Capability up to 1800 V," <i>Materials Science Forum</i> Vols. 338-342, pp. 1295-1298, 2000.		
98	R. Schorner, P. Friedrichs, D. Peters, and D. Stephani, "Significantly Improved Performance of MOSFETs on Silicon Carbide Using the 15R-SiC Polytype," <i>IEEE Electron Device Letters</i> , Vol. 20, No. 5, pp.241-244, May 1999.		
99	Ranbir Singh, Sei-Hyung Ryu and John W. Palmour, "High Temperature, High Current, 4H-SiC Accu-DMOSFET," <i>Materials Science Forum</i> Vols. 338-342, pp.1271-1274, 2000.		
100	S. Sridevan and B. Jayant Baliga, "Lateral N-Channel Inversion Mode 4H-SiC MOSFET's," <i>IEEE Electron Device Letters</i> , Vol. 19, No. 7, pp.228-230, July 1998.		
101	S. Sridevan, P.K. McLarty, and B.J. Baliga, "On the Presence of Aluminum in Thermally Grown Oxides on 6H-Silicon Carbide," <i>IEEE Electron Device Letters</i> , Vol. 17, No. 3, pp. 136-138, March 1996.		
102	S.T. Pantelides, "Atomic Scale Engineering of SiC Dielectric Interfaces," DARPA/MTO High Power and ONR Power Switching MURI Reviews, Rosslyn, VA, August 10-12, 1999.		
103	Suzuki et al. "Effect of Post-oxidation-annealing in Hydrogen on SiO ₂ /4H-SiC Interface," <i>Materials Science Forum</i> , Vols. 338-342 (2000) 1073-6.		
104	Sze, S.M. <i>Physics of Semiconductor Devices</i> , John Wiley & Sons, p. 383-390, 1981		
105	V.R. Vathulya and M.H. White, "Characterization of Channel Mobility on Implanted SiC to Determine Polytype Suitability for the Power DIMOS Structure," <i>Electronic Materials Conference</i> , Santa Barbara, CA, June 30-July2, 1999.		

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	106	V.R. Vathulya, H. Shang, and M.H. White, "A Novel 6H-SiC Power DMOSFET with Implanted P-Well Spacer," <i>IEEE Electronic Device Letters</i> , Vol. 20, No. 7, July 1999, pp. 354-356.	
	107	V.V. Afanasev, M. Bassler, G. Pensl, and M. Schulz, "Intrinsic SiC/SiO ₂ Interface States," <i>Phy. Stat. Sol. (a)</i> , Vol. 162, pp.321-337, 1997.	
	108	Wang et al. "High Temperature Characteristics of High-Quality SiC MIS Capacitors with O/N/O Gate Dielectric," <i>IEEE Transactions on Electron Devices</i> . Vol. 47, No. 2, February 2000, pp. 458-462.	
	109	Xu et al. "Improved Performance and Reliability of N ₂ O-Grown Oxynitride on 6H-SiH," <i>IEEE Electron Device Letters</i> . Vol. 21, No.6, June 2000, p. 298-300.	
	110	Y. Wang, C. Weitzel, and M. Bhatnagar, "Accumulation-Mode SiC Power MOSFET Design Issues," <i>Materials Science Forum</i> , Vols. 338-342, pp.1287-1290.	

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